PUBLIC PERCEPTION AND RESPONSE TO EXTREME HEAT EVENTS

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INTRODUCTION

In the United States extreme heat events have grown in size and stature over the past 20 years. Urban Heat Islands exacerbate these extreme heat events leaving a sizable portion of people at risk for heat related fatalities. The evidence of this is seen in the Chicago heat wave of 1995 which killed 500 people over the course of a week and the European heat wave of 2003 which killed 7,000 people in the course of a month. The main guiding questions then become how government and the media can most effectively warn people about the occurrence of extreme heat events? Should extreme heat warnings be issued by T.V., newspaper or by radio? Even if warnings are issued will the population at large still change their behavior? Another possible question is whether people most vulnerable to extreme heat will change their behavior? A survey in 2010 by NASA will be the main basis for this analysis. This survey set out to see how well people in Phoenix, Philadelphia, and Dayton responded to extreme heat alerts by changing their behavior. It also set out to see whether those that were most vulnerable to high heat and humidity were changing or modifying their behavior. Pie charts were compiled of the different survey questions based on quartiles of people to stratify the results of the survey. The quartiles were set up from those most likely to be affected by high humidity to those least affected by high heat and humidity. The results of this survey show whether respondents in Phoenix, Philadelphia and Dayton actually changed their behavior during heat related advisories.

BACKGROUND

Heat Waves and Urban Heat Island Effect

Heat waves are times of extended heat stress that cause changes in lifestyle as well as adverse health risks to the population at large. While heat waves are meteorological events, human perceptions of heat must be taken into account when defining a heat wave. Daytime high temperatures and nighttime low temperatures are also used when defining a heat wave. In heat indexes a variety of different factors are used including temperature, humidity, wind speed, turbulence and radiation. Human factors such as fitness, activity level, and clothing type are used as well. The National Weather Service uses a variety of these factors to mix temperature and humidity to get apparent temperature or heat index. The heat index is the temperature the person feels due to the humidity in the air (Robinson, 2001).

The National Weather Service defines a heat advisory as daytime highs of a region being greater than 105 degrees F and nighttime lows being greater than 80 degrees F for two consecutive days. Social and cultural practices also play an important role in human perception and response to heat. Areas with higher summer temperatures compensate for the heat in different ways. Some areas build different housing structures to maximize air movement through the house and provide shade as well. Other areas might modify their activity levels to ensure that their populations are not as affected by the heat as well. When heat waves strike urban areas, exacerbating the urban heat island effect, danger strikes the affected population (Robinson, 2001).

The definition of urban heat islands is simple to understand. It is based on the undeniable fact that urban areas are warmer then suburban or rural areas because of land

cover and surface types. This urban to rural minimum temperature gradient is higher for metropolitan areas with greater population change and higher populations. Higher building density, less vegetation, and open space also increase temperatures in cities across the United States. Impervious surfaces and structures through which water cannot penetrate also add to the temperature in cities, thereby increasing the urban heat island effect (Zang et al., 2011).

Six insightful studies have been done into the nature of the urban heat islands. A study in Detroit used monitoring stations to measure temperature and relative humidity to explain the nature of the urban heat island (Zang et al., 2011). A time-series analysis done in the late 1980's wanted to see the immediate and long term impacts of weather on total daily deaths (Braga et al., 2001). Baltimore and Phoenix Long Term Ecological Regions (LTER) were used to explore the nature of urban heat islands further (Heisler et al., 2000). Dew point and temperature sensors helped identify if rural variability had an effect on urban heat islands (Saffel et al., 2004). The issue of combating urban heat islands and their effects on cities across the United States was another area I did some research into as well (McPherson, 1994). The question of whether sprawling or compact cities have a greater impact on urban heat islands was also answered in another study. (Frumpkin et al., 2010)

HOBO sites were chosen to monitor areas with different impervious surfaces in Detroit. Seventeen different HOBO sites were set up throughout Detroit. Temperature and relative humidity readings at the sites were taken every five minutes for 22 consecutive days from August 9th 2008 to August 30th 2008. Then the temperatures and relative humidity readings were averaged for the morning (minimum), the evening

(maximum), and for the entire day at all the sites (Zang et al., 2011). Braga's time series analysis used cities that included Atlanta, GA; Birmingham, AL; Canton, OH; Chicago, IL; Colorado Springs, CO; Detroit, MI; Houston, TX; Minneapolis-St. Paul, MN; New Haven, CT; Pittsburgh, PA; Seattle, WA; and Spokane, WA. The daily counts of total deaths for these cities were done from 1986 to 1993. Deaths due to external causes were excluded from the research, and daily weather data were obtained from the airport of each city. (Braga et al., 2001)

In the Zang study it mentions that African Americans and people below the poverty line are two key demographics that are affected by high heat and humidity. The elderly and little children are some other key demographics that are affected by high heat as well. These demographics are mentioned since over 81 percent of Detroit's population is African American and 26 percent of the population is below the poverty line (Zang et al., 2011). Frumpkin's study also found out this same information and went on to name even more informative demographic factors in suffering from high heat. This study found that risk factors for heat related deaths include but are not limited to: being very old, very young, socially isolated, lacking air conditioning, or being very poor. Lack of education is also a risk factor in heat related deaths (Howard et al., 2010). Braga's time series analysis study found that cold weather cities had more heat related fatalities during heat related events than warm weather cities did. He also found out that the effects of these events lasted longer in cold weather cities than in warm weather cities (Braga et al., 2001).

The temperatures at the 17 different HOBO sites were significantly different from each other. The biggest spatial variation of temperature occurred for the maximum

temperatures, followed once again by the minimum temperatures and the mean temperatures. A correlation was found between minimum temperature, daily mean temperature and imperviousness. This same correlation, however, did not apply for maximum temperature. A HOBO's distance to water had a strong effect on average minimum, maximum and mean temperatures as well. The problem with this survey, however, is that it did not take into account land-use types, vegetation, urban morphology or buildings around the HOBO monitors (Zang et al., 2011). Braga's study showed that in warm weather cities heat related deaths occurred usually all at once, while in cold weather they were spread out over a greater period of time. The magnitude of hot temperatures was affected by central air conditioning and the variance of summertime temperatures. Global warming was also found to increase mean temperatures and temperature variability in these cities (Braga et al., 2001).

In Heisler's study LTER sites were set up to see the relationships between climate and land cover of urban vs. rural areas. Air monitoring and temperature sites for Baltimore were set up in urban areas such as the Inner Harbor area in downtown Baltimore, Baltimore-Washington Airport, Washington Dulles Airport and Washington National Airport, as well as the rural town of Woodstock, MD. Air monitoring and temperature stations for Phoenix were set up at Phoenix Sky Harbor Airport, Mesa, Tempe, downtown Phoenix as well as the rural town of Sacatoon (Heisler et al., 2000). Saffel's study used dew point and temperature sensors deployed over a small area of a local farm, with different land cover types, to measure temperature, dew point, wind speed and direction. These sensors collected temperature and dew point data every five minutes for 10 days (April 3rd, 2002 to April 12th, 2002) and then averaged this set of data

into hourly readings for both of these categories. T –test and z scores were compiled from the readings to see which sensors on the farm were warmer and cooler than the others (Saffell et al., 2004).

Heisler's study found that Dulles International Airport had rural temperature patterns while the other two airports used in this study had urban temperature patterns. Urban Baltimore was found to be 5 to 10 degrees warmer than the rural, residential area that surrounded it. Urban Phoenix was found to be 5 to 11 degrees warmer than open fed desert surfaces and well watered agricultural irrigated surfaces. The long term urban vs. rural temperature differential was found to have increased over time for both Baltimore and Phoenix. In the past couple of years, however, it was found that the urban vs. rural temperature differential is decreasing as urban metropolises take up formerly rural sites (Heisler et al., 2000). Saffel's study found that temperatures usually increased on the farm, while dew points decreased. The only exception was a cold front that came through on April 6th that brought colder temperatures and higher dew points. The grass field and the peach orchards were found to have the coldest temperatures on the farm. Dirt and dry field land cover types on the farm were found to be the warmest areas. The average urban heat island for any of these sensors was between 9.4 degrees Celsius and 12.9 degrees Celsius, a difference of about 3.4 degrees. The maximum urban heat island ranged from 10.7 degrees Celsius to 14.6 degrees Celsius, a difference of about 3.9 degrees. The important thing about this study is that researchers should be more cautious when assessing the impact of built environment (Saffel et al., 2004).

Macpherson's study deals with combating urban heat islands and their effects on cities across the United States. This paper was written with policy makers in mind;

giving them clear informative advice on how to curtail the effects of urban heat islands. Urbanization in the last 50 years has led to a steady increase of .1 to 1.1 degrees Celsius per decade in cities across the United States. In order to effectively offset the effects of Urban Heat Islands on electricity use in cities, a million dollars had to be spent per hour on electricity. For the whole year a billion dollars had to be spent on electricity alone! Urban Heat Islands also contribute to global warming since warmer temperatures bring out a greater demand for cooling. This means more coal is sent out, releasing more carbon dioxide into the atmosphere (McPherson, 1994). Frumpkin's study examined the correlation between sprawl and the rate of increase of EHE over a five decade period from the mid 1950's to the mid 2000's. To measure sprawl a sprawl index was used. The sprawl index took into account the centeredness, connectivity, density, and mix of land uses for 83 of the largest metropolitan areas across the United States as based upon the 2000 Census. This survey collected data for 53 out of the 83 cities since data was not available for the other 30 cities. The extreme heat event data were drawn from the heat stress index used for 187 U.S. cities. This index measures apparent temperature based on ambient temperature and water vapor pressure. These index results were collected for the 53 cities in question. Then the authors of the study measured correlation between the mean annual change of extreme heat events between 1956 and 2005 and the sprawl ranking of each city in 2000. A T-test was then performed in SPSS to see if there was statistical significance between mean annual change of extreme heat events and sprawl (Frumpkin et al., 2010).

McPherson's study showed that manipulating building density or street orientation might reduce the urban heat island effect. This solution, however, brings

forth new problems. This would cause the city to put forth money for new redevelopment projects which cost a good amount of money. A number of cities might not be able to afford this solution. The use of vegetation or light colored surfaces in these cities might be a better option. Light colored surfaces increase albedo, a surface's reflectiveness, by using light colored sands or dyes. Using light colored surfaces would allow for a savings of 62 percent for annual cooling as well as a 35 percent savings for peak cooling in these cities. In order to get the maximum cooling effect in cities this paper recommended that the below steps be taken. In parking lots trees should be planted in north-south rows in order to maximize shade. In parks it is important to have an open turf area that is well irrigated. Residential street lanes should be narrowed so traffic is forced to travel slower and emergency vehicles get better access. Large trees should be planted on the side of the road so they can provide adequate shade and comfort to pedestrians. This paper mentions that more studies and models should be done on urban climate in order to better inform policy makers of what to do about Urban Heat Islands (McPherson, 1994). Frumpkin's study showed that the frequencies of extreme heat events are increasing significantly on a yearly basis. They have been found to have increased by 2 days a decade for each city. This adds up to 10 more heat related deaths per city in 2005 than in 1956. It was also found that the rate of increase of extreme heat events varied by metropolitan form. The most sprawling cities experienced a rate of increase that doubles that of most compact cities. The correlation between mean annual change of extreme heat events and sprawl was found to be significant indeed (Frumpkin et al., 2010).

Public Perception of Extreme Heat

Studies also have been done into public perception on heat related events and whether or not there is a change of behavior amongst people because of these events. Heat events and air pollution events are increasing in scope due to the increasing urban heat island effect brought on by global warming. The need for timely public health responses is imperative as shown by Hurricane Katrina and the big European heat wave in 2003 that killed 70,000 plus people. It is also shown in the Chicago heat wave of 1995 that killed 500 people over the course of a couple of days. The public sees weather events such as hurricanes and tornadoes as more threatening than Heat Related Events (HRE). HRE's, however, kill on average 700 people in the U.S. each year. Air pollution has also become a big problem as well. Warning systems have been put in place to predict at what point meteorological or air conditions become hazardous enough to trigger air pollution or heat related alerts. Numerous studies have been done about how to best set up this warning system; however, not many studies have been done into how the public perceives these events and what they are doing to change their behavior.

Some studies, however, have been done into public perception of and behavior in extreme heat related events. A study was done in 2008 to see the public perception of hot weather and air pollution in Portland, OR and Houston, TX in order to see how effective these advisories are (George et al., 2008). A survey for five Canadian cities done in September 2010 saw people's perception of heat related events and what if anything they did to change their behavior. The five Canadian cities included in this survey are Winnipeg, MB, Windsor, ON, Fredericton, NB as well as Regina, SK and Sarnia, ON (Alhassan et al., 2011). A survey that has been done for Dayton, OH, Philadelphia, PA,

and Toronto, ON saw the public's reaction to heat related events as well (Sheridan, 2007). Finally, another study set out to review the risk factors associated with heat related events and to consider what a good public response to these events should be involving response plans, GIS and remote sensing methodologies, and effective communication strategies (Mc.Geehin et al., 2008).

For the Portland and Houston study a cross-sectional survey was done for selected air pollution and heat related events during the summers of 2005 and 2006. Subjects were found for the survey using random digit telephone dialing with geographic specificity of numbers. In each city the researchers surveyed 125 people per each heat related or air pollution episode. These phone interviews were set up to see what effect age, sex, health status, location, driving commute patterns, and availability of air conditioning had on people's perceptions of heat related events. Temperature, relative humidity, wind speed, solar radiation, ozone, nitric oxide, nitrogen dioxide were collected by Houston and Portland monitoring stations to measure the conditions of the atmosphere during heat related events. Heat index was also derived from ground based downtown temperatures and relative humidity for both Portland and Houston. Survey data were taken from C-SURVENT and exported into SPSS and Excel for analysis. To see if warnings brought about a change in behavior the chi square tests were used (George et al., 2008). The questionnaire for the Canadian study had five sections to it. The first section dealt with recalling heat related events for the summer of 2010 and previous summers. Section 2 dealt with the attitude people had towards what heat related responses should entail as well as their attitudes to heat related events. Section 3 dealt with what neighborhoods people lived in and what their air conditioning use was. Health

status questions were asked for Section 4 while Section 5 dealt with the typical socio-demographic questions based on age, gender, education, employment, and income (Alhassan et al., 2011).

The participants for George's study were similar in sex but differed in age, race, and income. These differences showed the general differences of Houston and Portland. The population of Portland is mostly white while the population of Houston has more racial and ethnic minorities (George et al., 2008). In Sheridan's study it was found that the respondents were similar in age and sex, being for the most part elderly females (Sheridan, 2007).

Changes in behavior differed throughout the studies but had some common points. In George's study air conditioning usage was found to be more in Houston than Portland, probably due to the warmer climate. Houston residents also ran their air conditioners more hours per day than Portland residents did. 94 % of Houston residents ran their air conditioners for more than 6 hours a day while 46 % of Portland residents did (George et al., 2008). In Alhassan's study it was found that air conditioning was shown to have an impact against the effects of heat related events and that there was prevalence of AC across some Canadian cities surveyed. Other cities like Fredericton, NB were found to have low prevalence of air conditioning (Alhassan et al., 2011). In the Sheridan study it was found that air conditioner use was greater in Phoenix than in the other three cities (Sheridan, 2007). George's study showed that during heat related events in both Portland and Houston drinking liquids increased as well as changes in certain behaviors such as exercise habits and wearing light color clothes (George et al., 2008). In Alhassan's study the residents coped with heat related events by spending time

in an air conditioned environment, staying inside, staying hydrated, spending time at a swimming pool or other body of water or spending time in the shade (Alhassan et al., 2011).

In George's study people were asked whether they would change their behavior during the next heat related event. Respondents in Portland were more likely to say that they would change their behavior due to advisory warnings. The survey questions found, however, that these advisories were not effective in changing people's behavior. In Houston and Portland only a very small portion of the population changed their behavior. If they did it was based on what they perceived to be poor air quality and extreme heat and not what the advisory said was poor air quality and extreme heat (George et al., 2008). In Sheridan's study only 46 % of the people in all four cities actually modified their behavior. This varied amongst the cities with Phoenix being the lowest at 35 % and Dayton being the highest at 57 % (Sheridan, 2007).

For the George study females in both Portland and Houston were more likely to perceive poor air quality and extreme heat than their male counterparts. A small percentage of females, however, actually changed their behavior. This percentage was on par with their male counterparts. Both cities saw people with lower incomes and educational attainment to be more perceptive to poor air quality and extreme heat. They were also found to be more responsive to both these conditions as well. The media need to do a better job of promoting the dangers of extreme heat and poor air quality to regular folks so they can change their behavior (George et al., 2008). Sheridan's study showed people need to differentiate between a day that is hot and a heat related event. A day that is hot might require some modifications to behavior, but a heat related event requires a

complete modification of behavior. It means more than just avoiding the outdoors but also drinking more water and perhaps even consuming more minerals (Sheridan, 2007).

The public's perception of extreme heat events differed throughout the studies but had some common points as well. George's study showed that people in Portland were more likely than the people of Houston to show symptoms of heat related events, but both cities were more likely to report dizziness when the heat index was above 35 degrees Celsius. In both Houston and Portland a third of the population knew that heat and air quality advisories existed. Television was the dominant medium in both cities for getting the word out about heat and air advisories. T.V. was followed by radio, newspaper, word-of-mouth, highway signs, email messages, as well as workplace notices (George et al., 2008). In Alhassan's study people were asked if there were times when the weather felt extremely hot during the summer. The vast majority, around 85 % of participants, felt the weather to be extremely hot. During the time of this study respondents in Fredericton, NB, Sarnia, ON and Windsor, ON were experiencing a heat related event. The weather had cooled off in Manitoba and Saskatchewan by that time, and the results of the survey reflected these facts (Alhassan et al., 2011). In Sheridan's study 90 % of the respondents were aware of the heat warnings being issued for these cities, and many had advance knowledge about these events a day in advance (Sheridan, 2007).

In Alhassan's study twenty percent of the respondents said that these heat related events affected their health and the vast minorities of these cases were found to have actually affected their health according to health care professionals. It was found that younger people (25-34) (35-44) reported the highest rate of illness during these heat related events, perhaps due to being outside for longer periods of time or to

misclassifying their illnesses (Alhassan et al., 2011). In McGeehin's study it was shown that good heat response plans vary across different regions but usually include a couple of key steps. Identifying the responsibilities of a lead agency and other local participating agencies and how they mesh with each other is a good step. Setting aside guidelines for activating and deactivating a heat advisory is also essential. Educating the public about heat related events and being in constant communication with them during summer is another way to drive home the dangers of these events (Mc.Geehin et al., 2008).

In Alhassan's study people were found to be aware of heat related events due to the medium of television and were also found to treat relatives, and people under their care, better than they treated themselves during these heat related events. Also the vast minority of people surveyed had heard of cooling areas in their city and a sizable majority of people had never heard of cooling centers at all. Educating people about cooling stations and where they are located in local neighborhoods would be a good start to combat heat related events in any city (Alhassan et al., 2011). McGheenin's study tells us that identifying at risk populations and using effective communication techniques during a heat wave is also important. One could argue that this is the most vital step in creating an effective heat response plan. GIS and Remote Sensing technology can also map out areas where vulnerable populations live at a micro or macro neighborhood level, always useful for governments wanting to create an effective Heat Response Plan (Mc.Geehin et al., 2008).

METHODS

In order to determine people's perceptions of extreme heat events as well as their behavior to such events, surveys have to be administered to the general public. One of these surveys was done for the cities of Phoenix, Philadelphia, and Dayton. This survey was administered by NASA and the Center of Disease Control and Prevention (CDC) in 2010 and wanted to see how the population in these cities responded to extreme heat events. The results of this survey were used to improve state and local health emergency plans, in order to prevent serious health problems during the next heat wave. The survey results were anonymous, voluntary, and confidential so the people taking this survey did not have to worry about their personal information being released for the general public to see. The respondent also had the ability during this survey to refuse to answer the question. The survey questions were divided into three different categories.

The first category of questions dealt with demographics. These questions asked the interviewee the number of people living in their house under 18, over 18, and if the interviewee was the head of the household. These survey questions also asked if the person knew of anybody at risk for extreme heat events in their household, and also what the household income for the past year excluding taxes was. The level of education question was split into different categories. The first category was less than high school, followed by high school graduate, some college, technical school, college graduate, post graduate and don't know. The household income question was also split into different categories as well. This category was split into an increment of $10,000 at first, with those making under $15,000 to those making $15,000 to $25,000. Then the categories

were split up into increments of $25,000, starting with those making $25,000 to $50,000 to those making over $100,000.

The next category of questions in this survey dealt with behavior. These questions asked responders where they got their weather information from, how likely their family would be to change their behavior during a heat wave, and how likely their family would talk about summer heat alerts if such alerts were broadcasted by the media. The answers for the weather information question were divided up into different categories. The categories were radio, television, internet, text messages, newspaper, other, and don't know. The categories for the answers to the other behavior questions were divided up into very likely, somewhat likely, not very likely, not at all likely, and don't know.

The next category of questions dealt with outdoor activities. These questions asked if the respondent had increased their intake of water to three or four glasses for every hour they were outside, if they had central air conditioning in their home, and if they had done activities slower than normal during a heat wave. Another set of queries also asked the respondent if they set the thermostat to turn on the air conditioner automatically, if they increased their intake of salt and minerals outdoors during a heat wave, if they had an air conditioner in at least one room of their house, and also if they use electric fans to keep themselves cool in their home. Other questions asked about how likely families of the different respondents told each other about extreme heat alerts, and if an outdoor activity had ever been rescheduled during a heat wave to another time of the day. The answers of queries about water, salt, slower activities and air conditioning were divided up into categories of yes, no, not applicable, don't know, or REF which meant

they refused to answer the question. The answer to the question of members of the household informing other members about extreme heat alerts was divided up into categories of very likely, somewhat likely, not very likely, not at all likely, don't know, as well as REF. The answers for the question about thermostats turning on automatically were divided up into categories of turns on automatically, leave turned off, other, don't know, or REF.

Pie charts were then created for the questions that dealt with Behavioral and Outdoor activities of people during heat waves. In the survey the people were divided up into 4 different groups or quartiles. They were divided into these groups based upon their likelihood of being susceptible to high heat. Quartile 1 included people, who were based on data, poor and very susceptible to high heat. Quartile 4 included people that were well off and not that susceptible to high heat. This makes sense since the richer you are the more money you can spend to provide for better air conditioning. If a person is poor and living in neighborhood housing, they won't spend the money on air conditioning but save it up for more important things like food and clothing. Quartiles 2 and 3 were in between the two extremes of 1 and 4 and dealt with mainly middle class people that were fairly well off and could afford air conditioning. In total 150 pie charts were created for all three cities.

During the making of the pie charts border edges had been left off a lot of the graphs making them look very sloppy in nature. The numbers representing each category had been graphed above and to the side of each pie chart. This makes it confusing for the attended audience to read the data. One of the postdocs in the geography department mentioned that the numbers for each category should be graphed directly below each

individual pie chart. That way it would be easier for the intended audience reading the pie charts, which in this case would be policy makers. Thankfully on the 4th floor of Cavanaugh Hall there is a color printer in which it is free to print up to 700 pages. This would come in handy for the number of pie charts that had to be printed.

The data for the Behavioral and Activity questions was then aggregated based upon question 18 of the survey. This question asked the participant in the survey what their income was before taxes. The first class was people making under $15,000 and went up in order to the 6th class which made up to $100,000 before taxes. The 7th and 8th class were basically other and did not know. In order to do this the old survey master for each individual city had to be copied. In each of the instances the column for question 18 had to be selected indicating I wanted to sort from smallest to largest. A pop up box came up and asked if the selection needed to be expanded upon or if I should continue on with the current selection. The mistake of continuing the current selection was made the first time. This option did not sort out the rest of the survey master based upon sorting done for question 18. Expanding the selection basically sorts out the rest of the survey master along with the previous sorting I had done for question 18. The post-doc pointed out this mistake to me and I had to do the second survey master for Dayton over again. Graphs were then created for each question based on each individual class. With there being 8 classes and 12 different questions around 300 graphs had to be completed for all three cities. This entire process took about a couple months to complete.

RESULTS

Quartiles 1 and 4 for all three cities, Dayton, Phoenix, and Philadelphia, all got their extreme heat warnings from the same sources of media. Respondents in all three cities said that television was their first choice in finding out about extreme heat warnings. The internet was their second choice, and newspapers and radio swapped between being the third and fourth choice based on the city and the quartile. This is not surprising since more people watch the evening news than read newspapers and listen to the radio. Today more and more people are connected to the internet, via their computers, phones and tablets, so it makes sense that the internet would be a major media source in finding out about extreme heat warnings. Respondents, throughout Quartiles 1 and 4, in all three cities said they were very likely or somewhat likely to change their behavior in an extreme heat event. They also mentioned that they would be very likely or somewhat likely to have a family discussion about heat related warnings. The question now becomes whether or not respondents actually changed their behavior throughout Dayton, Phoenix, and Philadelphia, especially those most vulnerable to heat- related fatalities in Quartile 1.

Respondents in Dayton, Phoenix, and Philadelphia verified that they increased their fluid intake by three to four glasses of water for every hour they were outside. Both Quartiles 1 and 4 for all three cities were equal in the percentages of people who increased their intake of fluids. Phoenix had the highest percentage of people who increased their intake of fluids out of all the three cities. Since Phoenix is in an arid desert climate and Philadelphia and Dayton are in moderate climates, it is understandable why more people would increase their water intake in Phoenix. Phoenix has more than

likely been through more heat events than Philadelphia and Dayton, so the population better knows how to increase water usage to combat extreme heat events. It also makes sense that people in Dayton, Phoenix, and Philadelphia would increase their intake of water during a heat wave since it is commonly cited that water replenishes nutrients lost during heat events. Tables 1, 2, and 3 show these results.

Table 1: Dayton fluids

	1 Yes	**2 No**	**7 NA (Does not go out during heat wave)**	**8 DK**	**9 REF**	
10. When you were involved in outdoor activities during a heat wave, have you ever increased your intake of fluids to three or four glasses of water for every hour you were outside?	95, **94**	50, **49**	6, **5**	1, **4**	0, **0**	152, **152**

Table 2: Phoenix fluids

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
10. When you were involved in outdoor activities during a heat wave, have you ever increased your intake of fluids to three or four glasses of water for every hour you were outside?	112, **113**	34, **32**	6, **5**	0,**0**	0,**0**	152, **150**

Table 3: Philadelphia fluids

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
10. When you were involved in outdoor activities during a heat wave, have you ever increased your intake of fluids to three or four glasses of water for every hour you were outside?	99, **92**	42, **45**	9, **12**	3,**3**	0,**0**	153, **152**

People in Dayton, Phoenix, and Philadelphia did not increase their intake of salt during extreme heat events. Both Quartiles 1 and 4 were equal in the number and percentage of people who had not increased their salt intake. Phoenix was found to have the highest percentage of people who had increased their salt intake. While many people equate drinking lots of fluids as a good step in combating heat, not a lot of people think about increasing their salt intake during an extreme heat event. This shows in the results for all three cities with people saying they did not increase their salt intake. This was shown by a margin of approximately 2 to 1. Increasing one's salt intake though has been found to effectively combat the effects of extreme heat. We can also surmise from the results that Phoenix, having gone through extreme heat warnings before, is a little more

educated about how increasing salt intake combats the effects of extreme heat. Tables 4, 5, and 6 show these results.

Table 4: Dayton salt

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
11. When you were involved in outdoor activities during a heat wave, have you ever purposefully increased your intake of salt and minerals to make up for what you had lost in perspiration?	45, **46**	102, **103**	3, **3**	2, **0**	0, **0**	152, **152**

Table 5: Phoenix salt

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
11. When you were involved in outdoor activities during a heat wave, have you ever purposefully increased your intake of salt and minerals to make up for what you had lost in perspiration?	58, **46**	90, **103**	2, **1**	0,**0**	0,**0**	152, **150**

Table 6: Philadelphia salt

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
11. When you were involved in outdoor activities during a heat wave, have you ever purposefully increased your intake of salt and minerals to make up for what you had lost in perspiration?	32, **29**	118, **112**	2, **10**	1, **1**	0,**0**	153, **152**

For question 12, respondents in all three cities were found to have purposefully slowed their activities outside during a heat wave. Quartiles 1 and 4 for these cities were equal in the percentage of people who had slowed down their activities during a heat event. Philadelphia was found to have the highest percentage of people who slowed their outdoor activities down. They were followed by Dayton, and then Phoenix. The first set of results is not surprising since a lot of news warnings on T.V. about extreme heat events tell people to take it easy on heat advisory days. These warnings include telling people not to water or mow their lawns on heat advisory days. What is surprising though is that Philadelphia had the highest percentage of people who slowed down their activities. This could be because most people might not go outside during an extreme heat event in Phoenix as opposed to the other two cities. This survey shows that people are making an effort to pace themselves during an extreme heat event. Tables 7, 8, and 9 show these results.

Table 7: Dayton slowdown

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
12. When you were involved in outdoor activities during a heat wave, have you ever purposefully done the activity much more slowly than normal so as not to get over-heated?	122, **120**	24, **27**	6, **5**	0, **0**	0, **0**	152, **152**

Table 8: Phoenix slowdown

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
12. When you were involved in outdoor activities during a heat wave, have you ever purposefully done the activity much more slowly than normal so as not to get over-heated?	115, **113**	31, **34**	5, **2**	0, **1**	1,**0**	152, **150**

Table 9: Philadelphia slowdown

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
12. When you were involved in outdoor activities during a heat wave, have you ever purposefully done the activity much more slowly than normal so as not to get over-heated?	127, **119**	19, **23**	6, **10**	0,**0**	0,**0**	153, **152**

Respondents in Dayton, Phoenix, and Philadelphia were found to have rescheduled outdoor activities to a cooler part of the day during an extreme heat advisory. Quartiles 1 and 4 for all three cities were equal in the percentage of people who rescheduled their outdoor activities during a heat event. Phoenix and Dayton were found to be approximately equal in the percentage of people who scheduled outdoor activities to cooler parts of the day, and Philadelphia lagged behind them. This is not surprising because during extreme heat warnings T.V. news personalities often mention to take it

easy and reschedule outdoor activities to cooler parts of the day if necessary. Tables 10, 11, and 12 show these results.

Table 10: Dayton rescheduling

	1 Yes	**2 No**	**7 NA (Does not go out during heat wave)**	**8 DK**	**9 REF**	
13. When you were involved in outdoor activities during a heat wave, have you ever rescheduled the activity to a cooler time of day?	125, **122**	22, **24**	3, **4**	2, **2**	0, **0**	152, **152**

Table 11: Phoenix rescheduling

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
13. When you were involved in outdoor activities during a heat wave, have you ever rescheduled the activity to a cooler time of day?	124, **126**	26, **22**	1,**2**	1,**0**	0,**0**	152, **150**

Table 12: Philadelphia rescheduling

	1 Yes	2 No	7 NA (Does not go out during heat wave)	8 DK	9 REF	
13. When you were involved in outdoor activities during a heat wave, have you ever rescheduled the activity to a cooler time of day?	118, **125**	30, **21**	5, **6**	0,**0**	0,**0**	153, **152**

Survey recipients in all three cities said that they were very likely or somewhat likely to tell their family members about an extreme heat warning. In Dayton, people who made up Quartile 4 were more likely to tell their families about extreme heat warnings than people in Quartile 1. Phoenix survey recipients for Quartile 4 were found to be equal in their percentage with Quartile 1 on the category of being very likely to tell their families about extreme heat advisories. Quartiles 1 and 4 for Philadelphia were the same as Phoenix in this regard. Philadelphia also had the highest number of people out of the three cities that were very likely or somewhat likely to tell their families about extreme heat advisories. Upon closer look, though, it is because all the respondents in Philadelphia answered that question while a good portion of the respondents in Phoenix and Dayton did not answer that question. People in Dayton, Phoenix, and Philadelphia were found to be good about getting the word out to their families about extreme heat warnings. Tables 13, 14, and 15 show these results.

Table 13: Dayton household

	1 Very likely	2 Somewhat likely	3 Not very likely	4 Not at all likely	8 DK	9 REF	
14. How likely are members of your household to tell each other about extreme heat warnings they may have heard?	53, **59**	26, **34**	12, **14**	5, **6**	0, **0**	0, **0**	96, **113**

Table 14: Phoenix household

	1 Very likely	2 Somewhat likely	3 Not very likely	4 Not at all likely	8 DK	9 REF	
14. How likely are members of your household to tell each other about extreme heat warnings they may have heard?	54, **53**	27, **41**	11, **16**	12, **15**	0,**0**	0,**0**	104, **125**

Table 15: Philadelphia household

	1 Very likely	2 Somewhat likely	3 Not very likely	4 Not at all likely	8 DK	9 REF	
14. How likely are members of your household to tell each other about extreme heat warnings they may have heard?	74, **66**	17, **31**	2, **9**	4, **5**	0,**0**	0,**0**	153, **152**

Respondents for both quartiles in Dayton and Phoenix overwhelmingly said that they had central air conditioning. Phoenix respondents for both quartiles had central air conditioning as well. What was interesting, however, was that Quartile 1 respondents in Philadelphia did not have central air conditioning while their compatriots in Quartile 4 overwhelming had central air conditioning. Quartile 4 for all three cities had a higher number of people with air conditioning than did Quartile 1. This does not sound surprising since people in Quartile 4 can better afford air conditioning than people in Quartile 1 can. The city with the highest number of people that used central air conditioning was Phoenix followed by Dayton and Philadelphia. For Quartile 4 in Phoenix, 148 out of 150 people used central air conditioning, while in Quartile 1, 141 out of 152 people surveyed used air conditioning as well. This makes sense since Phoenix knows how to prepare for extreme heat advisories. What is puzzling and concerning though is that Quartile 1 in Philadelphia had 42 out of 153 people only use central air conditioning. Quartile 4 for Philadelphia had 102 out of the 152 people surveyed with

central air conditioning. Either Philadelphia residents in Quartile 1 need to get better prepared for heat advisories with central air conditioning units or the government needs to step in and help out low income families with AC units. Tables 16, 17 and 18 show these results.

Table 16: Dayton central air conditioning

	1 Yes	2 No	8 DK	9 REF	
15. Do you have central air conditioning in your home?	100, **138**	52, **14**	0, **0**	0, **0**	152, **152**

Table 17: Phoenix central air conditioning

	1 Yes	2 No	8 DK	9 REF	
15. Do you have central air conditioning in your home?	141, **148**	11, **2**	0,**0**	0,**0**	152, **150**

Table 18: Philadelphia central air conditioning

	1 Yes	2 No	8 DK	9 REF	
15. Do you have central air conditioning in your home?	42, **102**	111, **50**	0,**0**	0,**0**	153, **152**

People in Dayton, Phoenix and Philadelphia were found to have had their thermostats set to turn on their air conditioners automatically. Quartile 1 and Quartile 4 had about the same percentages of people that had their thermostats automatically turn on their air conditioners for all three cities. In Dayton and Philadelphia, fewer people in

Quartile 1 answered this question than people in Quartile 4 did. In Dayton, 100 people out of the 152 people in Quartile 1 answered the question while in Philadelphia only 42 out of the 153 people answered this question for Quartile 1. Quartiles 1 and 4 for Phoenix were well represented with 152 out of the 152 people in Quartile 1 answering this question and 148 out of the 150 people in Quartile 4 answering this question. Not surprisingly, Phoenix had the highest percentage of respondents say they used their thermostats to automatically turn on their air conditioning. The lack of response from this question among respondents in Dayton and Philadelphia shows that this question should not be used as a means to distinguish if people have changed their behavior or not during heat related advisories. Tables 19, 20 and 21 show these results.

Table 19: Dayton thermostat

	1 Turns on automatically	**2 Leave turned off most of time**	**3 Other (SPECIFY)**	**8 DK**	**9 REF**	
15a. (IF "Yes") Do you have the thermostat set to turn on the air conditioner automatically, or do you leave the air conditioner turned off most of the time?	76, **115**	16, **15**	8, **8**	0, **0**	0, **0**	100, **138**

Table 20: Phoenix thermostat

	1 Turns on automatically	2 Leave turned off most of time	3 Other (SPECIFY)	8 DK	9 REF	
15a. (IF "Yes") Do you have the thermostat set to turn on the air conditioner automatically, or do you leave the air conditioner turned off most of the time?	134, **141**	5, **4**	2, **3**	0,**0**	0,**0**	152, **148**

Table 21: Philadelphia thermostat

	1 Turns on automatically	2 Leave turned off most of time	3 Other (SPECIFY)	8 DK	9 REF	
15a. (IF "Yes") Do you have the thermostat set to turn on the air conditioner automatically, or do you leave the air conditioner turned off most of the time?	31, **78**	7, **16**	3, **7**	1, **1**	0,**0**	42, **102**

In Philadelphia and Dayton, most of the respondents for Quartiles 1 and 4 said that they at least had one air conditioning unit in a room in their house. In Phoenix, most of the respondents in both quartiles said that they did not have an air conditioner in at least one room of their house. Quartile 1, though, had only 11 people answer this question while Quartile 4 only had 4 people answer the question. It's hard to tell behavior from Phoenix for this question since so few people answered it. After all, most people in Phoenix said that they had central air conditioning and now the responses from this question, limited though they may be, show that most of the people do not have at least an air conditioner in one room of their house. The people who responded to this question in Phoenix might have been the people in question 15 who did not have central air conditioning. Even in Dayton and Philadelphia there were a substantial amount of respondents from both quartiles who did not answer this question. This question should definitely not be used as a means to see if people have changed their behavior or not as Tables 22, 23 and 24 indicate.

Table 22: Dayton air conditioning

	1 Yes	2 No	8 DK	9 REF	
15b. Do you have an air conditioner in at least one room of your home?	46, **12**	6, **2**	0, **0**	0, **0**	52, **14**

Table 23: Phoenix air conditioning

	1 Yes	2 No	8 DK	9 REF	
15b. Do you have an air conditioner in at least one room of your home?	3,**0**	8,**2**	0,**0**	0,**0**	11, **2**

Table 24: Philadelphia air conditioning

	1 Yes	2 No	8 DK	9 REF	
15b. Do you have an air conditioner in at least one room of your home?	105, **43**	6, **7**	0,**0**	0,**0**	111, **50**

Respondents in Dayton, Phoenix and Philadelphia said that they use electric fans to keep themselves cool when it is extremely hot outside. The percentage of people who said they had electric fans was about the same for Quartiles 1 and 4 in all three cities. Quartile 1 respondents in all three cities were more likely to answer the question than Quartile 4. Respondents in Phoenix for both quartiles once again did not bother to answer the question. Quartile 1 had 18 out of 152 people answer the question while

Quartile 4 had 9 out of the 150 people answer the question. Once again, a substantial amount of respondents from both Dayton and Philadelphia quartiles did not answer the question as well. While it might be tempting to throw out this question as a way to see if people are changing their behavior; the responses from this question show some intriguing and disturbing trends. Using electric fans to cool oneself during a heat event has been shown to have negative effects. Instead of cooling the unconditioned area with cooler air, the fans blow the hot air from the heat wave around the room making the room hotter than it was before. People are better off doing nothing in a heat wave than using electric fans. What is worrying about this is the amount of people in Quartile 1 for all three cities who answered this question saying they used electric fans to keep cool in a heat wave. Especially disturbing is the data for Quartile 1 in Philly that shows 98 people saying they use electric fans to keep cool in a heat event. Quartile 1 for Philly also had the majority of their respondents say they did not have central air conditioning. News outlets, especially television news stations, need to be better about educating people about electric fans and the risks they pose during extreme heat advisories as Tables 25, 26 and 27 indicate.

Table 25: Dayton electric fans

	1 Yes	**2 No**	**8 DK**	**9 REF**	
15c. Do you use electric fans to keep yourself cool in your home when it is extremely hot outside?	67, **33**	9, **4**	0, **0**	0, **0**	76, **37**

Table 26: Phoenix electric fans

	1 Yes	2 No	8 DK	9 REF	
15c. Do you use electric fans to keep yourself cool in your home when it is extremely hot outside?	17, **7**	1,**2**	0,**0**	0,**0**	18, **9**

Table 27: Philadelphia electric fans

	1 Yes	2 No	8 DK	9 REF	
15c. Do you use electric fans to keep yourself cool in your home when it is extremely hot outside?	98, **58**	24, **16**	0,**0**	0,**0**	122, **74**

DISCUSSION/CONCLUSION

For the most part respondents in Phoenix, Philadelphia, and Dayton did an admirable job in modifying their behavior during extreme heat advisories. They rightfully perceived the threats of heat waves and for the most part took the necessary precautions in combating extreme heat advisories. Both Quartiles 1 and 4 were close to each other in their ability to take the right precautions. The most vulnerable people in all three cities were preparing themselves against the heat and humidity of extreme heat advisories. There was no huge disparity with Quartile 4 being able to handle the heat in all three cities, and Quartile 1 not being able to handle the heat. This bodes well for Phoenix, Philadelphia, and Dayton in keeping fatalities down during an extreme heat advisory.

People in Phoenix, Philadelphia, and Dayton for both quartiles said they would be able to tell their families about extreme heat events. This is not surprising since all the studies, in my lit review, indicated that respondents would tell their families about extreme heat events. It was also not surprising that television was the first choice in finding out information about extreme heat advisories in all three cities. The number one reason most people watch their local nightly newscasts is for the weather, so it makes sense that these people would get their information from T.V. It is also not surprising that the internet, newspapers, and radios rounded out the top 4 positions. Today people are more tuned in to the World Wide Web and websites like weatherchannel.com make it easy to check the weather at work or at home. Thanks to new technology not many people read newspapers, anymore, and therefore are unlikely to get information about weather from newspapers. Television has long surpassed radio as a medium of media, so

it makes sense that people would not get information about extreme heat advisories from radio. People are more likely to get information about extreme heat events from radio than newspapers, though, since more people listen to weather reports driving to work than reading about the weather in their local newspaper. Text messaging was the last choice for the respondent, which was believable. There aren't that many people that receive information about extreme heat advisories, or weather in general, from text message updates. These results overall were pretty predictable.

Not surprisingly the city that seemed to be doing the best in adapting their behavior was Phoenix. Due to the cities arid climate it makes sense that Phoenix would be educated in taking the steps to combat extreme heat warnings. Steps like drinking 3 glasses of water for every hour you are outside, increasing your salt intake during a heat wave, slowing down activities outside during a heat wave, not watering or mowing your lawn during peak heat hours (10 AM – 4 PM), and having central air conditioning. Dayton and Philadelphia not surprisingly lag behind because of their temperate Midwest climate. Temperate Midwest climates, until a couple years ago, have not had that much experience with extreme heat advisories. It makes sense that residents in those cities would not be as educated in taking the steps to combat extreme heat advisories.

A disturbing but not surprising trend for Phoenix, Philadelphia, and Dayton were people not increasing their salt intake across Quartiles 1 and 4. People know drinking more water during a heat wave, slowing down their activities, moving their activities to a different part of the day, or having central air conditioning are a good way to combat heat related effects. What people do not understand, though, is that increased salt intake combats heat related effects. Increasing salt intake is not just a way to decrease

metabolism but is also a way to combat the effects of heat. Not many television news stations bring this up during their weather reports. Local governments and news agencies in Philadelphia, Phoenix, and Dayton need to be doing a better job of informing citizens about the benefits of increasing your salt intake during a heat advisory.

The lack of central air conditioning among people in Quartile 1 for Philadelphia is unnerving. It is not good for Philadelphia that their most vulnerable residents to heat related events are left so vulnerable due to the lack of central air conditioning. A couple steps can be taken to ease this predicament. Residents of Philadelphia that make up Quartile 1 can take personal responsibility for their health and buy air conditioners. A lot of these people, though, do not have the money or credit to buy central air conditioning. The local government, in this case, may need to step in and help out by installing central air conditioning in these homes. After all if the summer weather trends of the past couple years continue then cities like Philadelphia might be in for more extreme heat advisories. This could be a bad sign for heat related fatalities in Philadelphia.

A difference between this study and George's study about heat advisory perception and changes in behavior is that recipients in this study were found to have actually changed their behavior. George's study recipients for Portland, OR and Houston, TX said they were going to change their behavior but didn't actually change behavior during extreme heat advisories. If they changed behavior it was due to what the recipients thought were extreme heat advisories and not what were actually extreme heat advisories (George et al., 2008). This study and Alhassan's study are similar in that they show the importance of air conditioning on combating the effects of extreme heat events. The Canadian cities that had central air conditioning were better off than those that did

not have central air conditioning in combatting extreme heat advisories. In Alhassan's study people combatted extreme heat events by heading to the pool, sitting in shaded areas, and drinking more liquids. Recipients in the Dayton, Phoenix, and Philadelphia study had different yet similar behavioral changes. These recipients drank more liquids, took it easy on outdoor activities, rescheduled outdoor events to cooler portions of the day, and brought central air conditioning units (Alhassan et al., 2011). A difference between the Phoenix, Philadelphia, and Dayton study and Sheridan's study is that Sheridan's study recipients did not change their behavior while this study did. People in Sheridan's study were well aware of extreme heat advisories and when they would occur. People in this study even knew these heat advisories would take place days in advance and yet the majority did not change their behavior (Sheridan, 2007). Mc.Geehin's study findings seem to be put to good use by the local government of Phoenix, Dayton, and Philadelphia. These cities seem especially good at identifying the responsibilities of a lead agency and other local participating agencies to see how they mesh up together since people in these cities are changing their behavior during heat waves (Mc.Geehin et al., 2008).

Phoenix, Philadelphia, and Dayton respondents are doing well in modifying their behavior for extreme heat events. They are not just saying they are getting prepared for these events, but they are actually becoming better prepared. People in all three cities do need to increase their salt intake during heat waves, and people in Philadelphia, especially Quartile 1, need to buy or receive central air conditioning. The general public, also, needs to be educated on electric fans and told that they add to heat related effects

brought on by these advisories. If these cities modify their behavior then they should be prepared for the next extreme heat advisory.

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CURRICULUM VITAE

Raymond E. Porter

Education

Bachelor of Science - Indiana State University, Terre Haute, IN, May 2010
Major: Geography
Master of Science - IUPUI, Indianapolis, IN, January 2013
Major: Geographic Information Science (GIS)

Work Experience

October 2012-present Central Indiana Land Trust, Indianapolis, IN
GIS Intern

- Helping construct maps of core conservation areas and green infrastructure for the 9 county Indianapolis metropolitan region.
- Constructing maps to see how future population growth affects Central Indiana's Land Trust green infrastructure network.

May 2012-September 2012 Indiana Department of Environmental Management, Indianapolis, IN
GIS Intern

- Mapped out environmental restrictive covenants based on legal descriptions using coordinate geometry (COGO).
- Updated institutional control registry.
- Assisted and completed other tasks for the supervising GIS- environmental manager and associates.

January 2012-present ESG Security Inc, Indianapolis, IN
Security Guard

- Assisted in security for events at Bankers Life Field house.
- Assisted in security for events at Super Bowl Village and Circle Center Mall during Super Bowl week.
- Assisting in security for events throughout Central Indiana.

April 2011-August 2011 Institute for Research on Social Issues-IUPUI, Indianapolis, IN
Work Assistantship

- Generated spreadsheets and graphs in Microsoft Excel for a heat related survey dealing with three cities: Dayton, Phoenix, and Philadelphia.
- Collected satellite imagery for different major U.S. cities.
- Generated many different mean temperature maps for the census tracts of 3 cities: Indianapolis, Dayton, and Philadelphia.

May 2008-August 2008 Eli Lilly & Company, Indianapolis, IN
Summer Intern

- Assisted and completed tasks for the supervising maintenance engineer and technicians.
- Created spreadsheets in Microsoft Excel for maintenance management.

May 2007-August 2007 Meijer, Greenwood, IN
Utility Associate

Monitored parking lot.
Responded to tasks, such as assisting customers and retrieving merchandise, as assigned by the Director of Building Services.

June 2005-July 2005 Indiana State Museum, Indianapolis, IN
Exhibition & Lab Assistant

Instructed visitors in the Nature Center.
Responsible for cleaning and closing the Nature Lab.
Instructed visitors on the "History of Cars" using the museum's 50's model replica cars.

Awards/Accomplishments

Donald G. Brown Scholarship; McBeth Talisman Award; Dean's List; Member of Gamma Theta Upsilon (International Geography Honor Society)
GPA 3.67/4.0 (Cum Laude)

Computer Skills

Software: Arc Map 9.3, Arc Map 10.0, Arc Map 10.1, Arc Scene 9.3, Arc Globe 9.3, Erdas Imagine 8.2, Erdas Imagine 9.3, Erdas Imagine 10.0, Arc Info, Microsoft Word 2007, Excel 2007, PowerPoint 2007, Access 2007, Visual Basic, C++, Python, SPSS.
Operating Systems: Windows 7, Windows XP.

Community Service

Lords Locker - fed homeless; March 2007, September 2010, December 2010, April 2011, November 2012
Fletcher Place - fed needy/homeless; August 2009, October 2010, December 2010, June 2011, December 2011
Maxwell House - serving and assisting children with special needs; December 2010
Franklin United Methodist Community - serving and assisting in an easter egg hunt for children of nursing home employees; April 2011
Mt. Auburn United Methodist Young Adult Life Group - Fed homeless in downtown Indianapolis; July 2012, August 2012, September 2012